

CLAIMS

1. An apparatus for producing puffed crackers from a starch-containing raw material by pressure-baking and expanding said raw material in a heated mould comprising an upper mould element, a lower mould element with therebetween a moveable peripheral mould element, said apparatus further comprising driving and expanding means for said mould, characterized in that
 - (a) said mould elements comprise the combination of a heatable stationary upper mold plate (1) comprising one or more downwardly directed upper die elements (2), said upper plate being detachably adjusted and fixed to an upper frame element of the apparatus frame, a heatable lower mould plate (3) comprising one or more upwardly directed die or punch elements (4) arranged in registry with said upper die elements, said lower mould plate being adapted to be moved upwardly and downwardly relative to said upper mould plate, and an intermediate, optionally heatable mold plate (6) of predetermined thickness in the height dimension disposed between said upper and lower mould plates, comprising one or more die holes (7) arranged in registry with said upper die elements (2) and lower punch elements (4), said intermediate plate being adapted to be moved upwardly and downwardly relative to said upper mould plate and said lower mould plate such that either one or both of said upper dies and lower punches are slidably received in said die holes so as to define mould cavities therein; and
 - (b) said driving means are directly connected to solely said lower mould or punch plate (3) and comprise at least one hydraulic cylinder piston unit (10) mounted directly below said mould plate, said piston having a driven shaft (9') connected with a carrier member (5,9) of said lower punch plate, whereby the driven piston shaft and the axis of the carrier member are disposed vertically in line; and
 - (c) wherein said cylinder-piston unit (10) comprises stepped inner chambers of different volume, adapted for differential oil outflow and for moving the piston in the downward direction at a substantially higher velocity than in the upward direction
2. An apparatus according to claims 1, wherein the cylinder/piston unit comprises the combination of two vertically aligned cylinder/piston elements (10').
3. An apparatus according to claims 1 or 2, comprising means for adjusting and controlling an expansion volume for said pressure-baked product within said heatable mold.
4. An apparatus according to claims 1 to 3, comprising means for controlling the retraction velocity of said cylinder piston resp. said lower punch plate (4) relative to the expansion speed of said pressure-baked product.
5. An apparatus according to claims 1 to 4, wherein said at least one cylinder piston unit comprises an upper oil port (21) and a lower oil port (22), and two respective oil lines connecting said oil ports alternately to a high pressure oil source and to an oil return reservoir of a hydraulic power system of the apparatus, said two oil lines passing through a valve unit capable of simultaneously switching the oil lines alternately to a high pressure oil feed (pump) connection and to a oil return (reservoir) connection.

6. An apparatus according to claims 1-5, comprising control and steering means acting on a hydraulic power system (11,16,17) linked with said cylinder piston unit (10) and on actuating means (8) for said peripheral mould (6), thereby enabling of independently moving and positioning, incl. temporarily holding and/or pressing, the lower punch (4) and peripheral mould (6) relative to the fixed upper mould plate (1) and to one another, wherein the cylinder piston is displaced in a desired direction over a predetermined stroke length by oil flow under pressure acting selectively on either side of said piston, said pressure oil flow being delivered from said hydraulic power system by selective actuation and positioning of a multi-position valve, through which are passing a first oil feed line to an upper chamber of the cylinder piston and a second return oil flow line from a lower chamber of the cylinder piston, said two oil flow lines being selectively switched to pressure oil feed and/or return flow according to the control position of said multi-position valve.

7. A method of manufacturing puffed food crackers of desired shape and texture by using an apparatus as defined in claims 1 to 6, said method comprising the steps of:
feeding a given amount of starch-containing raw material in a mould cavity formed by the heated punch and the peripheral mould, compressing and baking the material by moving the punch and peripheral mould upwards against the heated upper mould plate incl. holding the punch under pressure by means of the lower cylinder piston, optionally carrying out at least one intermediate partial expansion by releasing the punch downwardly for a desired small amount and time followed by at least one recompression by moving the punch upwards, expanding the pressure-baked material to a desired extent by quickly withdrawing the punch over a given distance within the mold cavity and keeping the punch a desired short time in this position, optionally slightly recompressing the expanded cracker for its thickness equalization, moving the punch and peripheral mould downwardly so as to completely open the mould cavity and render the expanded cracker free resting on the punch top surface, and discharging the expanded cracker from the punch.

8. A puffed food cracker directly obtained by the method of claim 7.

9. A puffed food cracker according to claim 8, having the form of a mini cake with concave or convex surfaces, optionally including coarse dimples.

10. A puffed food cracker according to claim 8, having the form of a thin chip of irregular tridimensionally bended shape of constant or varying thickness.